# A Model for Connecting Doctors to University Based Medical Resources through the Internet

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*Medical Students and academics at large universities have access to rich and varied information resources. These resources tend not to be available from off campus sites. We have been running a trial to connect practicing doctors to some of the medical resources that are available within our university. We are using the Internet to facilitate this process. In doing so, a large number of non academic, but very practical problems have had to be solved. We examine in particular the roles that Internet service providers and Internet information providers play in such a project. In particular we describe the factors used in advising users on external service providers, and why we as part of a university have chosen not to fulfil the internet service provision role ourselves.*

## INTRODUCTION

Universities play a pivotal role in training under and postgraduate students in medicine and related health sciences. They have large volumes of educational and research material available. This is generally restricted to students based on campus or within affiliated teaching hospitals. Through the use of the Internet these physical boundaries can be broken down, and the resources existing in electronic format within the university system can be made available to students and other interested parties at remote sites. It thus becomes possible to give doctors access to these resources through any external internet service provider. The use of the Internet, Electronic Publishing and Hypermedia for teaching students has been well documented,[1,2,3] and has been found to be a valuable addition to normal paper based methods of information dissemination. This is true also for the education of medical under and postgraduates.[4,5]

## BACKGROUND

Our need to deliver university based medical resources grew out of a long standing project to connect rural doctors to each other through an electronic bulletin board system. The aim was to provide low cost telecommunications for isolated rural practitioners. The PHOCUS[6] project produced two significant outcomes that we applied to this project. The first is that the creation of a stable communications infrastructure, with equipment, modems and software, is a specialist task that is best left to an external organisation with existing expertise and infrastructure for doing so. The second is that user support is absolutely critical, and significant investment needs to be made in providing an adequate help desk system for the large number of queries that is almost invariably generated. With these two lessons in mind, we began a trial towards the end of 1994 to connect members of various divisions of General (Family) Practice within Melbourne to Internet based resources within the Monash University Faculty of Medicine.

The trial was born as a result of an 18 month strategic exploration of the potential role of the Internet in general medical education[13] and medical informatics education[14]. Our unit began with a Gopher server, and then rapidly migrated to a Web server.

In parallel to the above, we have been able to provide all medical students with full, free access to the Internet. They also all have individual email addresses. First year students attend compulsory sessions dealing with electronic mail, world wide web, and other Internet related issues. The need to provide ongoing access to university based resources for these students once they graduate, as well as to allow current doctors to come back into the university system to access these resources, motivated the creation of our trial.

The following additional factors also guided our decision:

- the growth rate of the Internet guarantees its future importance. As the number of users increases, the number and quality of information resources will increase with it. Currently (April 1995), the growth rate of the World Wide Web component of the Internet is 10% per week, and that of the whole Internet is 10% per month.[7]
- the potential for communication and collaboration between doctors using this medium is significant.[8]
- the opportunity for ongoing study (and distance education) is also significant
- raised technical awareness of doctors. By improving the understanding of doctors, who are in the end the real users of any medical communications infrastructure, we hope that they will have the knowledge to avoid some of the costly information technology mistakes that have been made in the past, and be able to better guide government decisions on implementation strategies.

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## CAPABILITIES AND LIMITATIONS OF THE INTERNET

For the purposes of this discussion, we concentrate on the World Wide Web (WWW)[9], which is only one of many ways in which information can be distributed over the Internet.

Using the WWW offers the following benefits:
• Hypertext. This refers to the linking of related information so that users can access it in a non linear manner.[10] There is a large body of information describing the use of hypertext based information systems for information dissemination.[11]
• Mixed Media Elements. It is possible to embed graphics files directly into WWW documents, and to provide links to other media types including sounds, movies and animations.
• Cross Platform. Any document authored in Hypertext Markup Language (HTML)[12] can be displayed using any web client software, irrespective of the platform that the client software is running on. This allows the author of the information to concentrate on content, without concern about which hardware the end user will be using.
• Distributed. Once a document has been made available on an Internet connected web server, that document is available not only on campus, but to any user anywhere with Internet access. An author can thus reach a significantly larger audience than if the information were distributed in paper form.

There are however some disadvantages to using the WWW. These include:
• A current lack of high quality HTML authoring tools that run on common hardware platforms. This situation is changing rapidly, and large software houses are racing each other to produce such tools.
• Minimal control over the appearance of documents. HTML is designed to deal with the structure of documents, and only indirectly with their actual physical appearance. As a result, the normal typographic controls that most users who have published documents expect, are not fully possible.

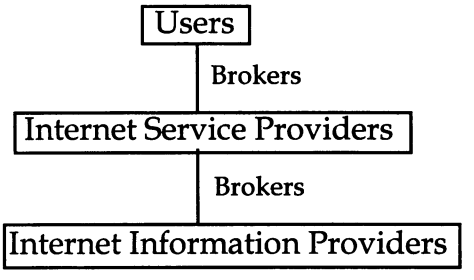
## OVERVIEW

We have identified three major issues involved in the provision of university based resources through the Internet for access by external parties. These are:
• Internet Information Providers
• Internet Service Providers
• Training and Support

We refer to the following terms in this discussion:
a) **Users**. Users are any individuals or groups who seek to have access to electronically accessible information resources which have been made available for their use (free of charge or through subscription) through the Internet.
b) **Internet Service Providers** (ISPs). ISPs are service companies which provide dial in access for Users to access the Internet.
c) **Internet Information Providers** (IIPs). IIPs provide information content for users to access once they are connected to the Internet.

It is important to understand the relationship between Users, Internet Service Providers, and Internet Information Providers.

The diagram below illustrates the relationship between these three groups. Note that there is an important role for Brokers to play in facilitating this exchange between the three groups.




## INTERNET INFORMATION PROVIDERS

A university is ideally placed to be an information provider due to the rich and varied resources at its disposal. By combining resources created by external medical groups (such as government, drug companies, and medical colleges) with teaching and research resources created by the university, both students and doctors benefit from the information interchange.

Information published on our Internet site (and most other sites in general) fall into three main categories:

1) Pointers. There are a large number of medical and other resources available on the Internet. Sorting these into logical order, and screening out irrelevant or poor quality resources is a time consuming but valuable exercise. Making the resulting links available to users saves them time, and increases the benefit they derive from the Internet. Many sites begin their existence by only providing pointer information, without much local content. As they mature and respond to user requirements, they add local content.

2) Local Content. High quality information that is relevant to a specific user community is what makes or breaks any internet based information service. We are currently focusing significant effort on obtaining permission to publish established and credible medical journals in electronic format. We believe that not only can a larger audience benefit from such publication, but that students within the university system will also benefit.

3) Specialised Content. Information that is of relevance only to a closed community of users, such as internal phone numbers, private email addresses, notices of meetings, and drafts of work in progress, can also be published on the Internet. We have provided groups within our trial with their own password protected areas on our web server, as well as their own private areas on our ftp server. This is coupled with mailing lists known only to members of the group. We have found that this type of content gives users a strong sense of involvement and ownership of the data that they are publishing.

## INTERNET SERVICE PROVIDERS

An ISP can be though of as a company with a large number of dial-in connections for users to access through the normal phone system, and a high speed connection to the Internet for connecting these users to the rest of the Internet.

They are generally expected to fulfil the following roles:
- provision of a dial in connection as described above
- provision of billing information for each user
- provision of suitable software for allowing users SLIP or PPP access
- provision of user support.

Our previous experience has shown us that we, as an Internet Information Provider, should not attempt to fulfil the above roles since they are not cost effective on a small scale, and they require significant initial infrastructure to provide quality service to Users. The only exception is that an information provider would be expected to provide user support for the information content that they provide, and that they often need to provide software that is further configured to allow users to access common Internet resources (particularly those provided by the information provider) without having to reconfigure the software.

In choosing an appropriate Internet Service Provider, the following physical and network capabilities of the various providers need to be considered. These factors need to be evaluated whether the decision is being made on behalf of a large number of users, or is being made by a single user for his or her own use.

1) Dial in number. This needs to be a local call cost number. For rural users, the option of using long distance calls to access city based providers, versus the use of the Australia wide packet switching network, needs to be examined in light of their distance from a major city center.

2) Modem speed. We advise the use of service providers who use exclusively high speed modems. At this point a high speed modem is one that is capable of transmitting information at 28,800 baud. Compression protocols can boost effective throughput above this.

3) Modem ratios. This refers to the number of dial in modems available per user. A ratio of 10 users per modem is considered adequate for general access.

4) Capital city interconnection. In Australia most large service providers have their own high speed fibre optic cable between the capital cities. This network allows them to transport local traffic at much higher rates than would be possible through the main, university owned Internet backbone.

5) Overseas connection. As with the previous point, the provision of a dedicated link to the USA means that traffic for users of that service provider can get overseas access much faster than if the normal university owned overseas link were used.

6) Proxy services. A proxy server is a server that fields requests on behalf of local users for information that is to be retrieved from remote sites. It then keeps a copy of the returned data in a large local hard disk cache. When a subsequent local user requests the same information from the same remote site, the request can be satisfied from the cache, and not only is the information returned to that user (and all subsequent users) much faster, but no unnecessary network traffic is generated.

7) Additional services. These include such things as availability of a full news feeds, and the ability to create local news groups and other value added services.

For most users the bottom line decision between service providers of similar capability is based on the cost of the connection.
We base our advice on the following factors:

1) The joining fee. This is perceived by most users to be a significant cost, however over several months any but a large difference (in excess of $100) becomes almost insignificant.

2) Hourly charge. This is the most significant factor in making a decision, as hourly charges are where the longer term ongoing costs lie. The true cost per hour is difficult to calculate precisely due to factor 4 below. Certain providers now have flat fee subscription rates with no hourly restrictions. They are preferred provided however that they are able to meet other requirements also (such as user support).

3) Volume charge. This refers to a cost per megabyte for information downloaded by the user. We do not recommend any service providers who have volume charges. There are two reasons for this. The first is that it makes it almost impossible for a user to budget costs, and the second is that it is very easy to generate a lot of traffic inadvertently when browsing the World Wide Web.

4) Packages. Most service providers aim to attract customers by having special packages combining

minimum monthly fees, off-peak periods, and other conditions. By choosing the right package significant savings are possible. We have found that these packages tend to fall into two main groups. The first is low monthly costs, but slightly higher per hour access costs. The second is high monthly costs, but lower hourly costs. These packages thus tend to meet the requirements of regular users with the second option, and infrequent users with the first option.

## TRAINING AND SUPPORT

Our training material is available on the Internet at http://www.monash.edu.au/informatics/training.

In our experience, one of the most costly and time consuming tasks is the provision of training and support. From the User's perspective, this is also the most important task. As mentioned above under Internet Service Providers, some of the load for user support can be provided by them. However, we felt that our user group (doctors) would receive much greater benefit from training if it were customised for their needs, and if they could train with other doctors in small groups.

Based on previous training experience, we concentrated on the following issues:

• Hands-on. Using the Internet is essentially a hands-on process. Little theory is required to use a graphical web client. The training we developed reflects this process. We have found that small groups of six to eight doctors, with at least one trainer for every four doctors, was optimal. Training sessions were limited to 3 hours in duration, and had doctors exploring on the net within half an hour. Theory and background were then subtly intermixed during the remainder of the session, with more complex concepts such as domain names explained to them at the time that they are using software where this makes sense in context.

• Foolproof Installation Software. Every minute saved on making a less than perfect set of installer disks results in many hours of user support. Connecting to the Internet involves a large number of configuration steps, including scripts for dialling and connecting the modem, IP numbers for domain name servers, addresses of proxy server and mail servers, and many other esoteric details. These need to be completely hidden from the user. The only thing they should need to know is their email address, and their password. The software should take care of all the rest. Despite such installation software having been developed by us, we find that most users still call the support number at least once during the first week.

• Support Number. Doctors tend to be loyal to the group that trained them and that provides their information content, and thus direct all their queries to this group, rather than to the service provider that they are using. A seven day support number is critical, particularly an after hours number. Such a number is required because we have found that most doctors tend to use their Internet software when they have an hour or so spare, and this is invariably in the evening or on weekends.

• Follow up meetings and User groups. Getting doctors together at regular meetings helps in sharing ideas, sorting out problems, and gaining new skills. The contacts that they form between individuals also result in information sharing, and can decrease the user support required as the doctors begin to seek advice from their colleagues rather than from the support line. Such meetings are also an ideal opportunity to demonstrate new leading edge internet applications (such as video or voice conferencing) to maintain enthusiasm.

## CONCLUSION

The lessons learnt during this project to date confirms many of our previous experiences. Two in particular have been reconfirmed most strongly.

The first is to concentrate on areas of strength. Our strength is in Information Provision, and as such we are concentrating all our efforts on obtaining high quality information resources for doctors and medical students. Our strength is certainly not in Internet Service Provision. We do have the facility to provide dial in access, and we do have the technical know how to scale this up. What we do not have however is the existing infrastructure and long term experience to do so professionally. In particular however, as academics we do not have the interest to create such an infrastructure. As a result we leave all service provision to external providers.

The second is the importance of user support. Despite past experience, we still tend to underestimate the human resources required to run a proper support system. After the initial training period, most of the person (not Internet and email) based contact the doctors have with us is through our support number. The person who responds to such calls needs to be both technically knowledgeable, but in particular have exceptional communication skills to keep these users satisfied.

We are currently exploring funding opportunities to scale this project up from dozens of users to hundreds of users. It is our hope that we can foster the development of a well connected and well informed community of medical doctors.

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